FRD Activities Report
November 2003

Research Programs

ET Sphere

FRD has continued to look at modifications to the ET probe's design that will reduce or eliminate fouling of the pressure ports by rain water. The simplest approach being investigated is to enlarge the ports and to slope all the plastic tubing upward towards the top of the sphere. This reduces the effects of capillary action and allows gravity to aid in keeping the tubing clear. One of the existing spheres was modified by replacing the original 0.0625 inch ID tubing with 0.25 inch ID tubing. As shown in Figure 1, the new tubing is routed to the top of the sphere; the original smaller-diameter tubing will then be used from the top of the sphere back down to the pressure sensors. To avoid a constriction at the sphere surface, the pressure ports were drilled out to the outside diameter of the new tubing (Figure 2). This allows the ends of the tubes to be mounted flush with the outside of the sphere.

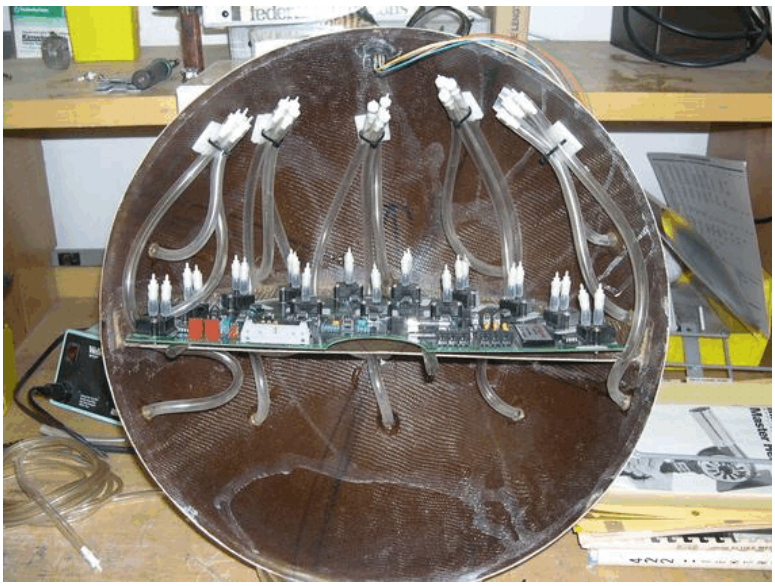

Figure 1. Interior of modified ET probe sphere showing the larger tubing routed to the top of the sphere.

Figure 2. Exterior view of modified ET probe showing the enlarged pressure ports. The ends of the tubes shown in Fig. 1 are mounted flush with the exterior surface of the sphere.

The advantages of this approach are that it requires no additional power and it does not require any changes to the electronics or software. ATDD is pursuing an alternate approach that uses an air pump to actively backflush the ports. Neither approach has yet been tested under realistic hurricane conditions, so it is unclear how well they will reduce the water fouling problem. It is

possible that ET probes of both designs will be deployed during the next hurricane season.

An abstract was submitted to the 26th Conference on Hurricanes and Tropical Meteorology, to take place in Miami in early May 2004. The proposed paper would describe progress to date on the ET probes. (Richard.Eckman@noaa.gov)

JOINT URBAN 2003

We are continuing to work towards the completion and release of the two SF_6 tracer data sets collected during the Joint Urban 2003 project, i.e., the continuous analyzers and the bag samplers (PIGS). The data from the continuous analyzers has been completely reviewed and all areas that require special flags have been identified. A number of errors were discovered and corrected during this process. The last hurdle remaining is acquiring good positions (i.e. longitude, latitude) for the analyzers during the various intensive observation periods (IOPs). The continuous analyzers were mounted in minivans that were parked in different locations during the IOPs. By examining operator log books and Operations Center notes, we identified approximately 40 locations where the sampling vans were parked during the experiment. The GPS positions acquired at each of these locations were then examined. By eliminating positions without enough satellites or with too high error values, we obtained reasonable GPS positions could be obtained for about half of the locations. The remaining 20 locations were documented as completely as possible with written descriptions and photographs, and then sent to the University of Oklahoma. Personnel at OU will then determine positions from the GIS database developed for Joint Urban 2003.

Work on the data from the bag samplers focused primarily on determining the Method Limit of Detection (MLOD) and Method Limit of Quantitation (MLOQ) for the plastic samplers or Super PIGS. During the past several months, a number of tests have been run to determine the cause of sampler quality control problems observed in the Super PIGS. (See the Oct. 2003 FRD Monthly Report for a more complete discussion.) Among other things, these tests showed that a significant amount of outside air leaked into the sample bags during sampling operations of the Super PIGS. Fortunately, when the samplers sample "outside air", leakage of a little more "outside air" into the bags does not present a problem. However, the MLOD and MLOQ are typically set by looking at the results of blank and control QC samplers. Blanks are samplers that sample from source bags filled with nitrogen instead of outside air. Controls are samplers that sample from source bags filled with known concentrations of SF_6. In these cases, leakage of "outside air" into the bags caused significant problems. Thus, the results from the blank and control QC samplers are unusable.

Without the blank and control QC samplers to work with, the MLOD and MLOQ had to be determined using a different calculation method. Fortunately, all of the sampler tests discussed in last month's report were set up so that the first two bags of each sampler were filled with only background levels of SF_6 in the test enclosure. SF_6 was introduced into the enclosure during the sampling of Bag 3. Thus, the first two bags provided a set of background level samples that were handled similarly to the samplers used in the experiment and were exposed to high levels of SF_6 as were the samplers used in the experiment. Using these numbers yields a MLOD of 33 ppt and a

MLOQ of 111 ppt. These values are significantly higher than the values for the PIGS (or paper samplers) which were 1 and 4 ppt, respectively. However, the higher values do not diminish the worth of the Super PIGS data because these samplers were exposed to higher levels of SF_6 than were the PIGS.

We also completed an additional test on the PIGS (paper samplers). Some of our previous tests indicated that bags filled after the sampler is exposed to high levels of tracer show slightly elevated concentrations even though all tracer has been flushed out of the area. This last test used the same sampling methods used during Joint Urban 2003 and demonstrated that bags exposed to high levels of SF_6 contain approximately 0.08% of the highest concentration the sampler was exposed to. We are currently reviewing PIGS data from the experiment to determine if this was a problem. (Roger Carter, Debbie Lacroix; roger@noaa.inel.gov, debbie@noaa.inel.gov)

CBLAST-Low

Work continues on data analysis from the 2001 field campaign. A paper outlining a comparison between buoy-measured winds and LongEZ-measured winds is in preparation. This paper highlights the methodology developed and refined by ATDD and FRD scientists to derived winds from the LongEZ measurement system. Several methods for correcting winds to 10 m neutral conditions, parameterizations used in the TogaCoare Alogrithm, and spatial averaging techniques are all explored in this paper. (Tami Grimett, Jeff.French@noaa.gov)

CBLAST-High

Two abstracts were submitted for the AMS 26th Conference on Hurricanes and Tropical Meteorology to be held in Miami in May. The first paper focuses on the development and evolution of the BAT probe from an instrument mounted on light aircraft operating in fair weather conditions to one robust enough to fly through hurricanes. Several iterations from the original design were necessary to produce an instrument capable of operating under such conditions. The second paper focuses on measurements in Hurricanes Fabian and Isabel. In these two storms, ARL scientists and the NOAA P-3 crew acquired for the first time ever estimates of boundary layer fluxes in hurricanes. A third paper, which ARL scientists are listed as co-authors, will focus on estimates of heat and momentum flux calculated using data from the BAT probe compared with a bulk scheme using data from drop sondes. (Jeff.French@noaa.gov)

SERA Program

A government contractor, Conklin and DeDecker, has begun an A-76 study into the feasibility for contracting SERA operations for ARL. A cost analysis for the SERA program was prepared and is being supplied to Conklin and DeDecker for use in the A-76. The outcome of this study, expected in early January, will determine the future of the SERA program within ARL. Phil Hall, OMAO officer currently assigned to AOC, is working with Jeff French to determine the requirements and associated costs for engineering and testing modifications to a SERA. AOC is responsible for the safety of any aircraft within the NOAA fleet. Although the SERA would be operated by ARL, AOC will work closely with ARL scientists and administrators to assure a safe

and useful operation. (Jeff.French@noaa.gov)

Homeland Security Tracer Study in New York City

Discussions have been held with personnel from DHS in conjunction with Bruce Hicks from ARL HQ regarding an atmospheric tracer study to be conducted next calendar year in Manhattan. FRD has been asked to help write the experimental plan, and is pleased to be in on the planning from the experiment's inception. We are waiting for a white paper from DHS that discusses the overall goals of the experiment before we begin designing the experiment. (Kirk.Clawson@noaa.gov and Bruce Hicks)

Cooperative Research with INEEL

INEEL Support

Meetings were held with INEEL contractors to discuss possible changes to the RSAC files used to compute doses in the MDIFF model. INEEL apparently wants to update the dose conversion factors contained in these files, and they want to make sure that any changes are compatible with the MDIFF software. FRD wants to avoid any changes to the RSAC files that would require major changes to the MDIFF code, unless supplemental funding is provided for the effort. (Richard.Eckman@noaa.gov)

INEEL Mesoscale Modeling

A number of upgrades and improvements have been made to the MM5 forecast system being run at FRD. NCEP has for some time provided the 12 km Eta model output in a tiled format, but until recently this output was missing important variables necessary for initializing MM5. This problem has been fixed by NCEP, so the FRD simulations are now being initialized solely from the 12 km tiled output. One benefit of this change is that the total number of Megabytes being downloaded from NCEP has dropped considerably, so the download time is now just a few minutes. Early on, the download time was a considerable fraction of the total time required to run the MM5 simulations. Another change is that the newest versions of the MM5 programs have been installed. These newer versions seem to provide much improved estimates of near-surface winds and temperature than the older versions.

Steps are also being taken to use 4D data assimilation with frequent updates. A new configuration of MM5 is being tested which assimilates the INEEL Mesonet data every 15 minutes, and also uses any satellite-derived winds and temperatures available within the model domain. Eventually, this configuration may also assimilate University of Utah MesoWest data and commercial aircraft (ACARS) data. Overall, these changes should significantly improve the skill of the INEEL MM5 forecasts. (Richard.Eckman@noaa.gov)

Other Activities

Security & Safety

Messrs. Joe Thill and Keith Turbitt from MASC Security conducted a DOC Office of Security Anti-Terrorism Risk Assessment for three days in early November. Overall, the office is in fairly good shape in complying with various DOC and NOAA mandates, such as having a Continuity of Operations Plan (COOP) in place. On completion of the assessment, Messers. Thill and Turbitt issued a draft report which indicated that FRD was determined to be a medium risk facility. In order to decrease the risk to low, the authors estimated a cost to NOAA of $8.7 to $15k for various countermeasures. (Kirk.Clawson@noaa.gov)

Papers

An abstract entitled *Development and Deployment of an Omnidirectional Pressure-Sphere Anemometer for Observing Winds and Turbulence in Tropical Cyclones* by Rick Eckman was submitted to the 26th Conference on Hurricanes and Tropical Meteorology, to take place in Miami in early May 2004.

An abstract entitled *Modification of an Airborne Gust Probe for Hurricane Boundary Layer Measurements* by Jeff French (Randy Johnson) was submitted to the 26th Conference on Hurricanes and Tropical Meteorology, Miami, May 2004.

An abstract entitled *Turbulent Flux Measurements within a Hurricane Boundary Layer from an Instrumented Aircraft* by Jeff French (Peter Black) was submitted to the 26th Conference on Hurricanes and Tropical Meteorology, Miami, May 2004.

An abstract entitled *Air-Sea Flux Estimates in Hurricanes Fabian and Isabel* by Eric Uhlhorn (Peter Black, Jeff French, Will Drennan) was submitted to the 26th Conference on Hurricanes and Tropical Meteorology, Miami, May 2004.

Travel

Several FRD staff members paid a visit to the Pocatello NWS Field Office on 6 November to discuss possible joint efforts and to sit in on seminars given by NWS staff. The discussions identified several areas of possible collaboration, including the high-resolution MM5 modeling effort at FRD. There appears to be interest from both groups in building the links between the two organizations. (Richard.Eckman@noaa.gov, Kirk Clawson, Jeff French, Neil Hukari)

Visitors

Joseph Thill and Keith Turbitt from DOC Security, November 3-5.